

Intro to Pressors

Jenny Denk, PGY3

Outline

1. 4 types of shock
 - a. How to determine which type of shock your patient has
2. Case based discussion of basic vasopressor physiology
 - a. How to order the pressors in the EMR
 - b. Peripheral pressors
3. Rapid fire pressor cases
4. A new pressor?

Table 4. Summary of Vasoactive Agents With Relative Receptor Affinities, Dosing, and Suggested Indications for Specific Pathology Use

	α_1	β_1	β_2	Dosing	Indication(s)
Phenylephrine	+++	-	-	100 mcg/min	Vasodilatory, procedural
Norepinephrine	+++	++	-	5 mcg/min	septic and cardiogenic
Dopamine	-	-	-	1-3 mcg/kg/min	cardiogenic, septic, and neurogenic
	+	++	-	5-10 mcg/kg/min	START AT 5mc/kg/min
	+++	++	-	10-20 mcg/kg/min	
Epinephrine	+++	++	++	1 mcg/min	cardiogenic, septic, and anaphylactic
Dobutamine	+	+++	++	2 mcg/kg/min	cardiogenic & septic
Vasopressin	N/A; \uparrow intracellular Ca^{2+}			0.04 U/min	septic and cardiac (high cardiac output)

Key: "+" = degree of receptor effect through activation; "-" = no effect on receptor subtype; CO = cardiac output.

*There is a theoretical maximum dosing concentration, but this has not been clearly established.^{46,63}

<https://dailyem.wordpress.com/2015/04/14/visual-aid-quick-pressor-reference/>

*Edits made to table to reflect dosing at our hospital

Case 1

47y female with pmhx DM, HTN, obesity who presents with fever, vomiting, malaise

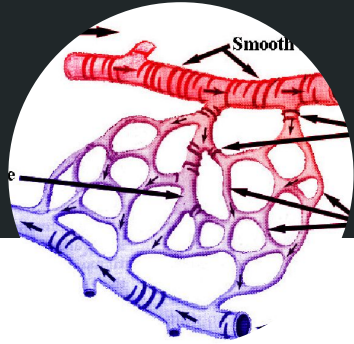


Vital Signs

<input type="checkbox"/> Temperature	(H) 38.7		36.9
Temperature Source	Rectal		Oral
<input type="checkbox"/> Post PRN Med Temperature			
Post PRN Med Temp Source			
<input type="checkbox"/> Heart/Pulse Rate	(H) 133	(H) 132	(H) 140
<input type="checkbox"/> Heart Rate ANES			
Pulse Source	Monitor	Monitor	Monitor
<input type="checkbox"/> Respiration Rate	(H) 34	(H) 36	(H) 28
<input type="checkbox"/> Respiratory Rate ANES			
<input type="checkbox"/> SpO2	100	100	(L) 94
<input type="checkbox"/> SPO2 ANES			
<input type="checkbox"/> NIBP Systolic	102	104	114
<input type="checkbox"/> NIBP Diastolic	65	(L) 52	68

4 types of shock

4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

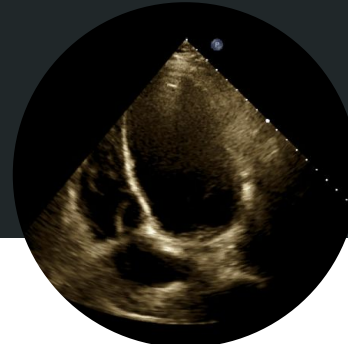


Hypovolemic

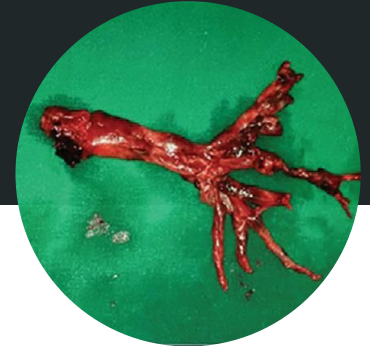
Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



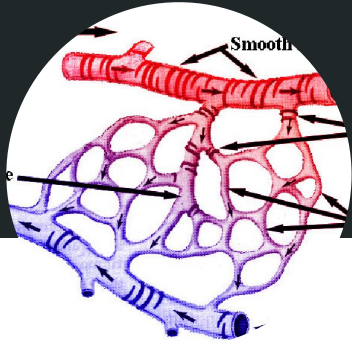
Obstructive

Pulmonary Embolism

Pericardial Tamponade

Tension Pneumothorax

4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

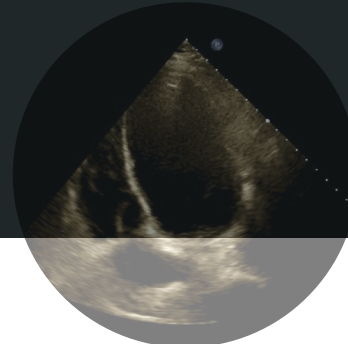


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



Obstructive

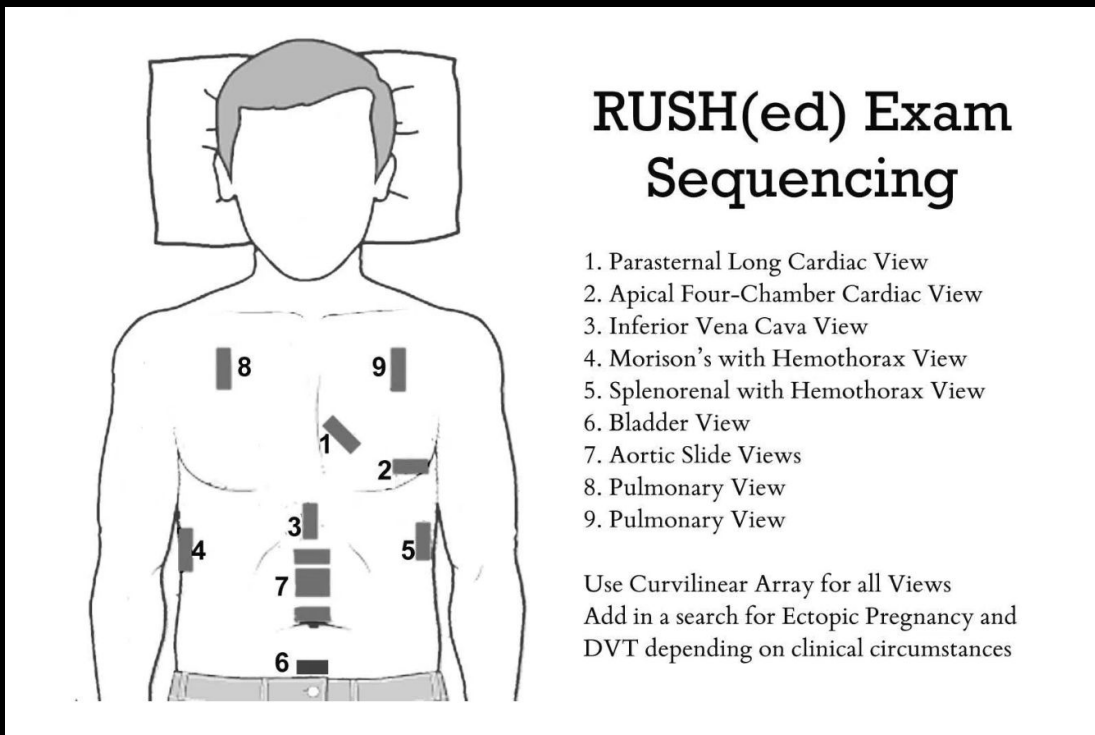
Pulmonary Embolism

Pericardial Tamponade

Tension Pneumothorax

How to determine type of shock

- History
- Physical
 - Cold vs warm extremities
- US
 - Echo
 - IVC
 - Lungs



Vasopressors

Norepinephrine

Vasopressin

Phenylephrine

Dopamine

Epinephrine

Dobutamine

Milrinone

Vasopressors

+ Add | Document Medication by Hx | Reconciliation | External Rx History | Rx Plans (1): Plan name not...

Reconciliation Status

Meds History | Admission | Discharge

Orders Document In Plan

+ Add to Phase | Check Alerts | Start: Now | Duration: None

View

- ED Sepsis PowerPlan CMC (Initiated)
- ED Cardio- Pulmonary PowerPlan CMC
 - ED x Respiratory Medications PowerPlan CMC
 - ED Behavioral Health PowerPlan CMC
 - ED x Respiratory Medications PowerPlan CMC
- ED Cardio- Pulmonary PowerPlan CMC
 - ED Behavioral Health PowerPlan CMC
- Orders
 - LET Orders
 - Admission Orders
 - Consults
 - Continuous Infusions
 - Diagnostic Imaging
 - Diagnostic Tests
 - Laboratory
 - Medications
- Diagnoses & Problems
- Related Results

\$	Component	Status	Dose ...	Details
	Vasoactive Agents			
	Goal is to raise MAP above 65 mmHg (or SBP above 90 mmHg). Arterial line recommended if blood pressure cuff reading is unreliable.			Norepinephrine (Levophed)
<input type="checkbox"/>	NOREpinephrine (Levophed) 8 mg/250 mL NS IV premix		250 mL, IV, TITRATE to MAINTAIN titrate by 5mcg/min every 5 min	
<input type="checkbox"/>	EPINEPHrine 4 mg/250 mL NS IV premix		250 mL, IV, TITRATE to MAINTAIN titrate by 1mcg/min every 5 min	
<input type="checkbox"/>	Vasopressin (Pitressin) 40 unit/100 mL NS IV for Septic Shock		100 mL, IV, IV Soln	
<input type="checkbox"/>	DOPamine 800 mg/250 mL D5W IV' premix		250 mL, IV, TITRATE to MAINTAIN then titrate by 2.5 mcg/kg/min e	
	Consider Dobutamine if ScvO2 less than 70% and hemoglobin greater than 10 g/dL. raise hemoglobin above 10 g/dL.			If hemoglobin is le
<input type="checkbox"/>	DOBUTamine 1,000 mg/250 mL D5W IV' premix		250 mL, IV	

Details

Dx Table | Orders For Cosignature | Save as My Favorite | Orders For Signature

Case 1 - pick your pressor

47y female with pmhx DM, HTN, obesity who presents with fever, vomiting, malaise

Fluids

Still hypotensive

SEPTIC SHOCK

Pressors

Table 4. Summary of Vasoactive Agents With Relative Receptor Affinities, Dosing, and Suggested Indications for Specific Pathology Use

Which pressors can we run peripherally?

				Dosing	Indication(s)
Phenylephrine	+++	-	-	100 mcg/min	Vasodilatory, procedural
Norepinephrine	+++	++	-	5 mcg/min	septic and cardiogenic
Dopamine	-	-	-	1-3 mcg/kg/min	cardiogenic, septic, and neurogenic START AT 5mc/kg/min
	+	++	-	5-10 mcg/kg/min	
	+++	++	-	10-20 mcg/kg/min	
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Vasopressin	N/A; ↑ intracellular Ca ²⁺			0.04 U/min	septic and cardiac (high cardiac output)

Key: "+" = degree of receptor effect through activation; "-" = no effect on receptor subtype; CO = cardiac output.

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Peripheral pressors since 2016

- All vasopressors have the potential to cause damage with extravasation
- IO, peripheral IV, midline
 - You need a good peripheral line
 - Location?
 - Size?
 - US guided
 - Nurse checks?
- Max dose peripherally?
- Why do a central line?
 - SvO₂, CVP
 - Expected course

Rough guideline for prolonged peripheral pressors

- Use epinephrine or phenylephrine
- Use a well-functioning 18-20G IV proximal to the wrist
- Bp cuff located on contralateral arm
- Inspect IV site q1hr for signs of extravasation
- If possible, ask patient to report any discomfort around the IV
- Be prepared to manage extravasation if it occurs:
 - There should be a 2nd IV available to infuse the vasopressor
 - Treat immediately with sq phentolamine

<https://emcrit.org/pulmcrit/phenylephrine-epinephrine-central-access/>

Case 1 - continued

47y female hx DM, HTN, obesity who presents with fever, vomiting, malaise

MAP 60 on 20mcg/min of norepinephrine

Table 4. Summary of Vasoactive Agents With Relative Receptor Affinities, Dosing, and Suggested Indications for Specific Pathology Use Which pressor would you add next?

	α_1	β_1	β_2	Dosing	Indication(s)
Phenylephrine	+++	-	-	100 mcg/min	Vasodilatory, procedural
Norepinephrine	+++	++	-	5 mcg/min	septic and cardiogenic
Dopamine	-	-	-	1-3 mcg/kg/min	cardiogenic, septic, and neurogenic
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Goal of vasopressors

1. Maintain critical perfusion pressures
 2. Increase venous return
 3. Avoid gut ischemia
- a. Brain
 - b. Heart
 - c. Kidneys

Goal MAP = 65

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	+++	++	-	10-20 mcg/kg/min	
Epinephrine	+++	++	++	1 mcg/min	cardiogenic, septic, and anaphylactic
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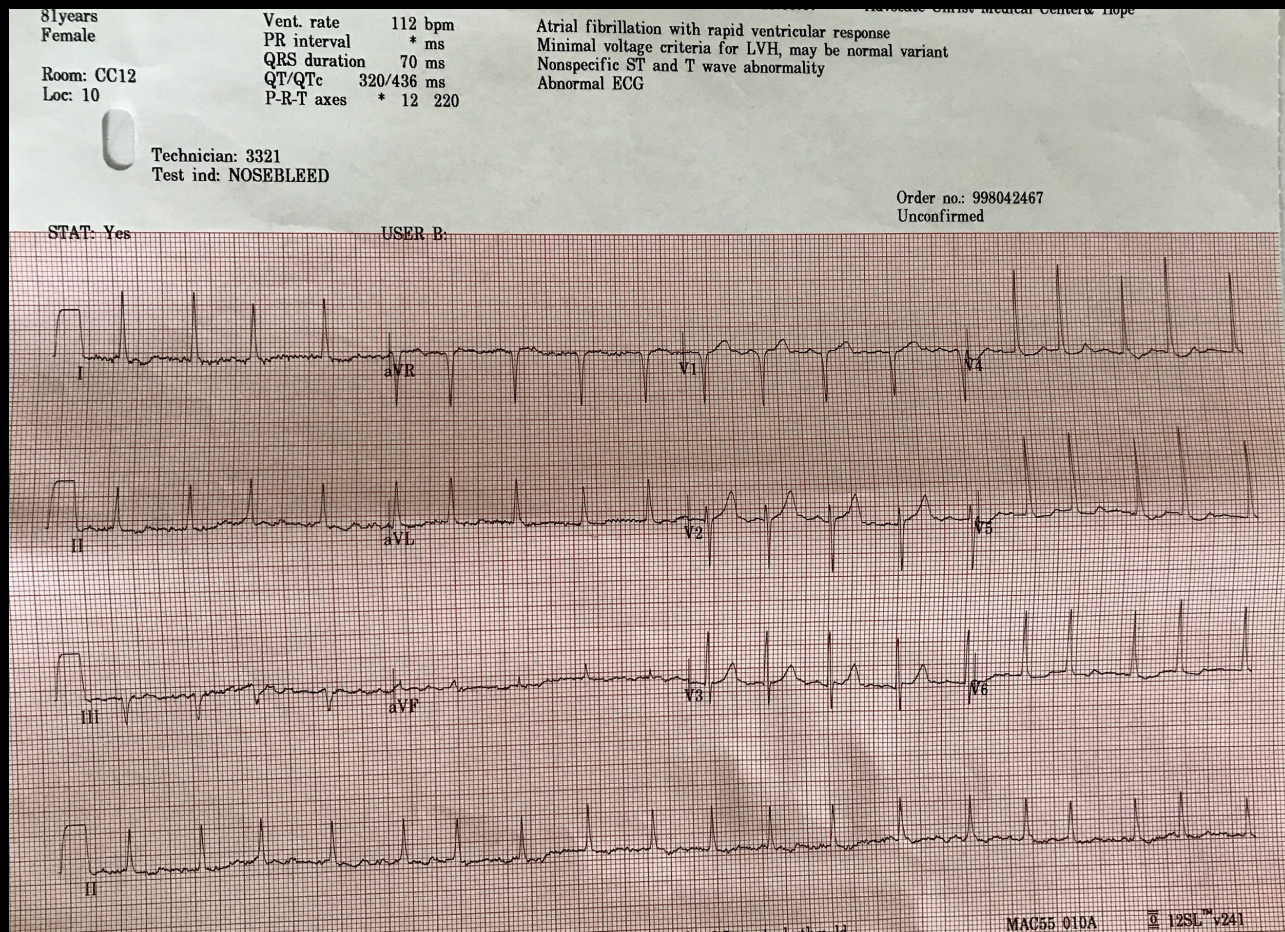
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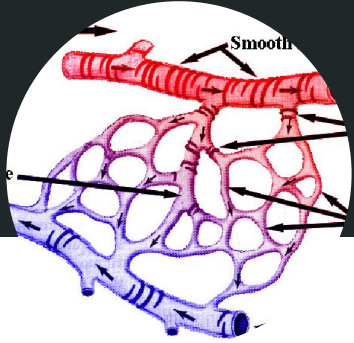
Case 2

81y female NH patient
presents with fever
and cough

HR 120s, BP 90/48,
Temp 38.4, RR 24, O2
92% RA



4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

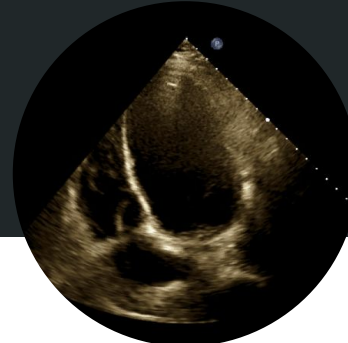


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



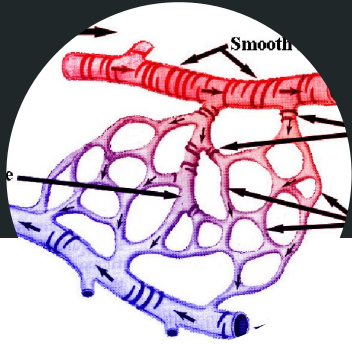
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Pulmonary Embolism

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4 types of shock



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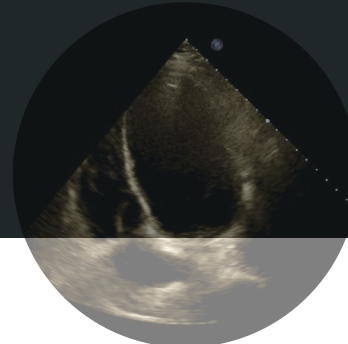


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



Obstructive

Pulmonary Embolism

Pericardial Tamponade

Tension Pneumothorax

Case 2 - pick your pressor

89y female NH patient presents with fever and cough

SEPTIC SHOCK

Which pressor is best in septic shock if you are worried about tachycardia?

Table 4. Summary of Vasoactive Agents With Indications for Specific Pathology Use

	α_1	β_1	β_2
Phenylephrine	+++	-	-
Norepinephrine	+++	++	-
Dopamine	-	-	-
	+	++	-
	+++	++	-
Epinephrine	+++	++	++
Dobutamine	+	+++	++
Vasopressin	N/A; \uparrow intracellular Ca^{2+}		

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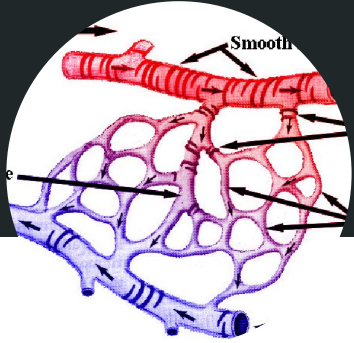
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Case 3

70y male with hx of afib on coumadin with BRBPR x 2

HR 120, BP 90/48, Temp 36.4, RR 18, O2 94% RA

4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

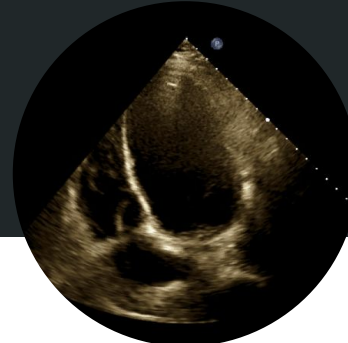


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



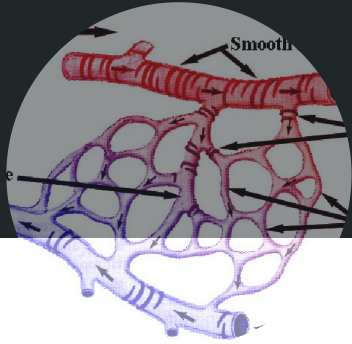
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4 types of shock



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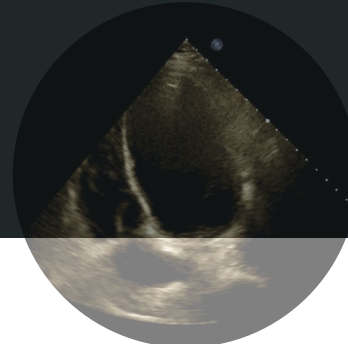


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



Obstructive

Pulmonary Embolism

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Tension Pneumothorax

Case 3 - pick your pressor

70y male with hx of afib on coumadin
with BRBPR x 2

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	+++	++	-
Epinephrine	+++	++	++
Dobutamine	+	+++	++
Vasopressin	N/A; \uparrow intracellular Ca^{2+}		

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Case 3 - pick your pressor



If BP not improving, will also need to reverse anticoagulation

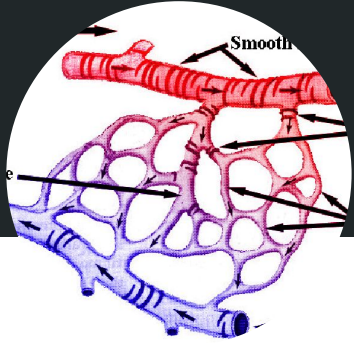
Case 4

55y female presents with allergic reaction

Vitals HR 100, BP 90/48, Temp 36.4, RR
14, O2 98%

angioedema picture
removed

4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

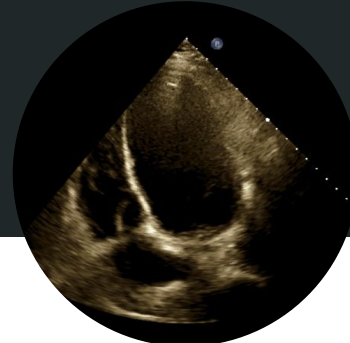


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



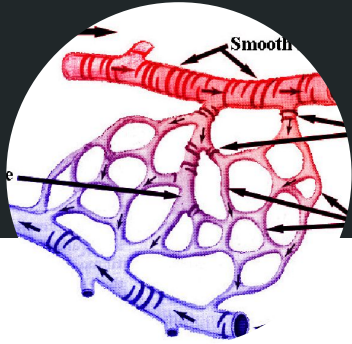
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4 types of shock



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Septic

Anaphylactic

Neurogenic

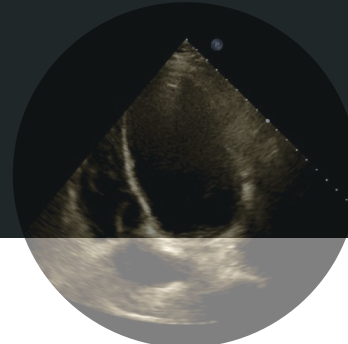


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



Obstructive

Pulmonary Embolism

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Case 4.5 - pick your pressor

55y female hx HTN presents with tongue swelling

Vitals HR 120, BP 130/88, Temp 36.4, RR 14, O2 100% but after sedation with fentanyl and propofol pt becomes hypotensive...

Decrease sedation or start pressor?

norepinephrine

angioedema picture removed

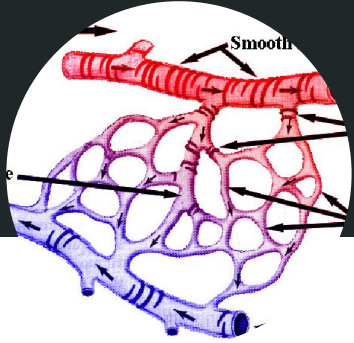
Case 5

67y male hx HTN, COPD, CHF, CVA

VITALS	06/20/17 07:28
Temperature Source	
<input type="checkbox"/> Temperature Intravascular	
<input type="checkbox"/> Heart/Pulse Rate	(H) 116
Pulse Source	Monitor
<input type="checkbox"/> Respiration Rate	(H) 26
<input type="checkbox"/> SpO2	100
Pulse Ox Probe Site	
<input type="checkbox"/> NIBP Systolic	(L) 88
<input type="checkbox"/> NIBP Diastolic	67
NIBP Source	
<input type="checkbox"/> NIBP Map	74

echo removed

4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

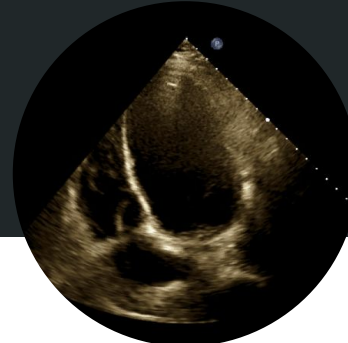


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



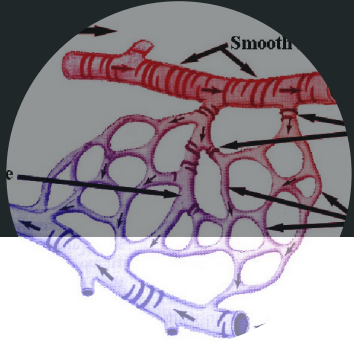
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4 types of shock



Distributive

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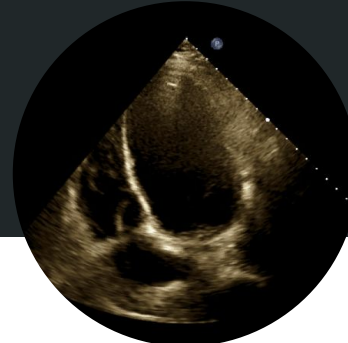


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



Obstructive

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Case 5

CARDIOGENIC SHOCK

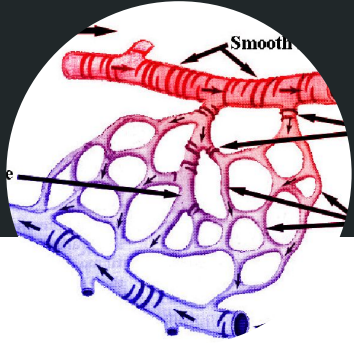
dobutamine or milrinone + norepinephrine

Case 6

62y male presents with difficulty
breathing

RV strain echo removed

4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

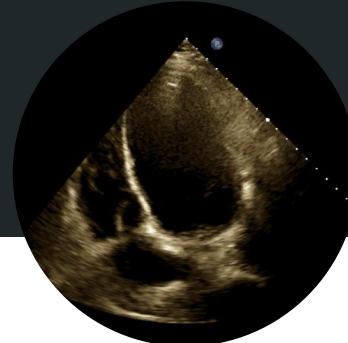


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



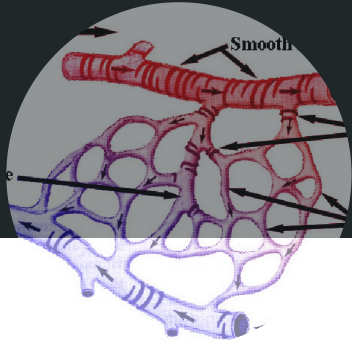
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4 types of shock



Distributive

Septic

Anaphylactic

Neurogenic

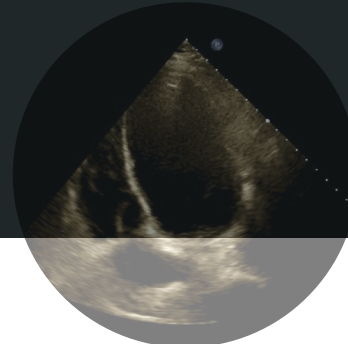


Hypovolemic

Hemorrhage

Vomiting/diarrhea

Dehydration



Cardiogenic



Obstructive

Pulmonary Embolism

Pericardial Tamponade

Tension Pneumothorax

Case 6

62y male presents with difficulty breathing

If hypotensive → **MASSIVE PE**

Needs TPA or embolectomy

Pressor of choice in meantime = **norepinephrine**

Rapid fire pressors

Septic shock

Norepinephrine

Then add vaso

Then add epi, dopa, phenylephrine

Rapid fire pressors

Anaphylactic shock

Epinephrine

Rapid fire pressors

Neurogenic shock

If bradycardic → epi, dopa

If NOT bradycardic → epi, phenylephrine

Rapid fire pressors

Cardiogenic shock

Milrinone, Dobutamine

Add: **norepinephrine**, epi, dopamine

Angiotensin II

- 1961 trial said angiotensin II works in septic shock
- Angiotensin II causes efferent vasoconstriction → increases urine output and CrCl
 - Norepi causes afferent vasoconstriction
- Angiotensin II improves microcirculation by causing postcapillary sphincter constriction

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Angiotensin II for the Treatment of Vasodilatory Shock

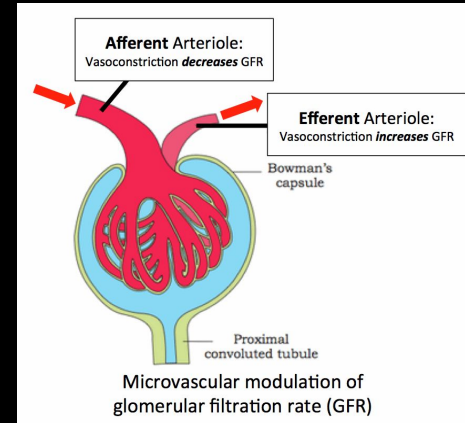
Ashish Khanna, M.D., Shane W. English, M.D., Xueyuan S. Wang, M.D., Kealy Ham, M.D., James Tumlin, M.D., Harold Szerlip, M.D., Laurence W. Busse, M.D., Laith Altaweel, M.D., Timothy E. Albertson, M.D., M.P.H., Ph.D., Caleb Mackey, M.D., Michael T. McCurdy, M.D., David W. Boldt, M.D., Stefan Chock, M.D., Paul J. Young, M.B., Ch.B., Ph.D., Kenneth Krell, M.D., Richard G. Wunderink, M.D., Marlies Ostermann, M.D., Ph.D., Raghavan Murugan, M.D., Michelle N. Gong, M.D., Rakshit Panwar, M.D., Johanna Hästbacka, M.D., Ph.D., Raphael Favory, M.D., Ph.D., Balasubramanian Venkatesh, M.D., B. Taylor Thompson, M.D., Rinaldo Bellomo, M.D., Jeffrey Jensen, B.S., Stew Kroll, M.A., Lakhmir S. Chawla, M.D., George F. Tidmarsh, M.D., Ph.D., and Adam M. Deane, M.D., for the ATHOS-3 Investigators*

CONCLUSIONS

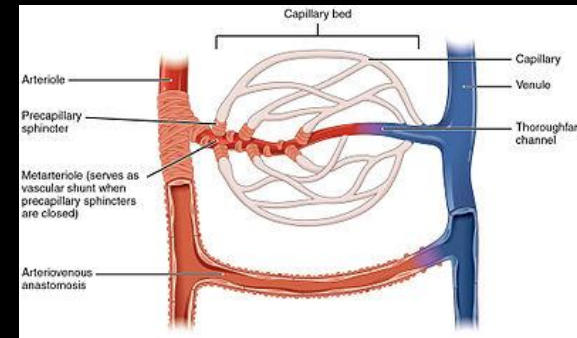
Angiotensin II effectively increased blood pressure in patients with vasodilatory shock that did not respond to high doses of conventional vasopressors. (Funded by La Jolla Pharmaceutical Company; ATHOS-3 ClinicalTrials.gov number, NCT02338843.)

Angiotensin II

- 1961 trial said angiotensin II works in septic shock
- Angiotensin II causes efferent vasoconstriction → increases urine output and CrCl
 - Norepi causes afferent vasoconstriction
- Angiotensin II improves microcirculation by causing postcapillary sphincter constriction

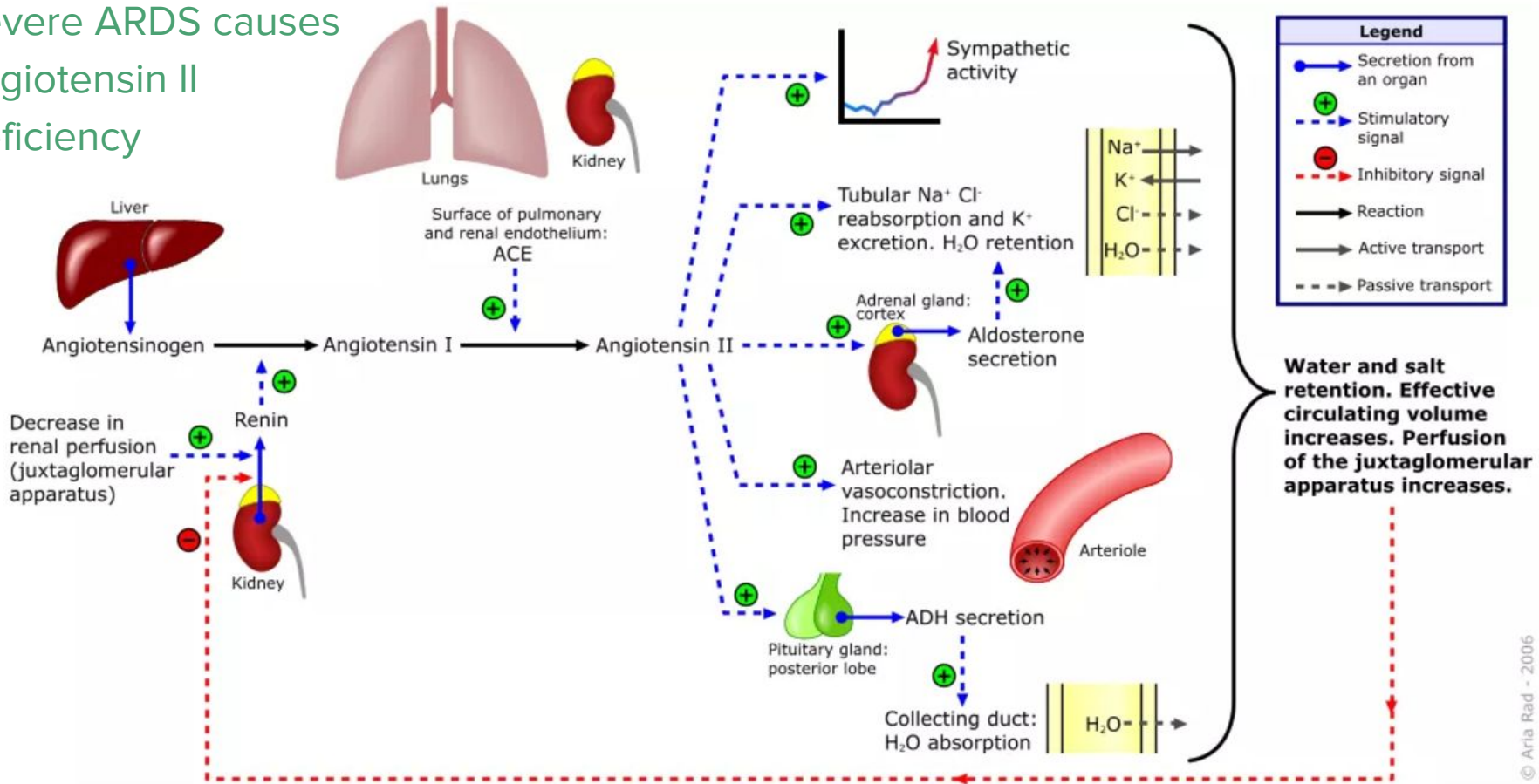


<https://www.google.com.au/search>



https://en.wikipedia.org/wiki/Precapillary_sphincter

Severe ARDS causes angiotensin II deficiency



Take home points

1. There are 4 types of shock. You can't properly treat the hypotension until you know what type of shock your patient has.
2. Know which pressors are for which types of shock, and if you don't know, **norepinephrine** is usually a safe choice.
3. Know your options for peripheral pressors.